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FINGERPRINT IMAGE INPUT DEVICE
[Shimon' gazo nyuryoku sochi]

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Specifications

1. Title of the Invention

Fingerprint Image Input Device

2. Claims

(1) A device for obtaining a fingerprint image by pressing a finger onto a transparent body; a fingerprint image input device characterized by providing a means for perceiving pressure in a singular or a plurality of locations on the aforesaid transparent body on which the finger is pressed, and providing a mechanism for picking up the fingerprint image when all pressure values in the aforesaid singular or plurality of locations are wholly a certain fixed value or more, or within a fixed range.

(2) The fingerprint image input device of Claim 1 characterized by using a spring or contact as the means for perceiving the pressure in a plurality of locations.

(3) The fingerprint image input device of Claim 2 characterized by using a piezoelectric element as the contact.

(4) The fingerprint image input device of Claim 2 characterized by using a slide contact as the contact.

(5) The fingerprint image input device of Claim 2 characterized by using a contact constituted from piezoelectric elements with 2 different characteristics as the contact and a circuit for taking an AND of a signal from the piezoelectric element on the side turned to an ON state at low pressure and an inverted signal of the signal from the piezoelectric element on the side turned to an ON state at high pressure.

(6) The fingerprint image input device of Claim 1 characterized by integrating the transparent body and the mechanism for picking up the fingerprint image.

3. Detailed Specifications

This invention pertains to a device for realizing image pickup in a uniform pressed state when a fingerprint image is obtained by pressing a finger onto a glass surface or the like without using ink.

A method in which image pickup is performed by utilizing light reflection by pressing a finger onto a glass plate and a method in which image pickup is performed by utilizing the variation in the light passage coming from the contact parts and noncontact parts of the fingerprint by pressing the finger on a prism are used as methods for collecting fingerprint images without using ink. Substantial variations in the obtained fingerprint images occur from the standpoint of the profile of the finger itself depending on the biased condition of the force during pressing, the pressing strength, the direction in which the finger is pressed, etc. Consequently, in order to perform a processing for fixing a fingerprint, it is important to first collect fingerprint images in the same state as best possible. A solution is possible for the finger direction problem from these problems by providing a guide or the like to perform pointing of the finger, but the problem of bias and the strength of the force during pressing are unresolved.

The objective of this invention is to perform image pickup of a fingerprint image when the bias and the strength of this force are uniform. This invention is explained in detail below.

Figure 1 is a practical example of this invention. Figure 1(a) is a side view and circuit block diagram; Fig. 1(b) is a top view of Fig. 1(a) and a circuit block diagram. **1** in these drawings is a finger; **2** is a transparent body such as a prism; **3** is a spring; **4** is a pressure-sensitive part; **5** is an AND gate; **6** is a controller; **7** is an image sensor part; **8** is a light source; **9** is an interface; **10** is a fitting or the like for applying a uniform pressure to the aforesaid pressure-sensitive part **4**.

The principles of operation in Fig. 1 are explained below. Figure 1(a) is an example when pressure is perceived in 4 locations, as shown in Figure 1(b). If the finger **1** is pressed onto the prism **2**, as shown in Fig. 1(a), the pressure thereof is transmitted to the pressure-sensitive part **4** through the spring **3**. The spring **3** incites the person pressing to correct his pressing by maintaining a degree of freedom in the movement of the prism **2** corresponding to the pressing of the finger **1**, and also acts in clarifying the variation in the pressure applied to the pressure-sensitive part **4** in 4 places. The pressure-sensitive parts **4** are in ON states, that is, a "1" signal is sent to the AND gate **5** only when the magnitude of this pressure is a certain value or more, or a value within a certain range. This operation is performed in all 4 pressure-sensitive parts **4**; hence, the signal "1" in the ON state is sent to the controller **6**

only when the pressure in all 4 pressure-sensitive parts **4** is a certain value or more, or within a certain range due to the action of the AND gate **5**. Here, the dotted line in Fig. 1(a) shows the signal line from the pressure-sensitive part **4** on the side which is not denoted in the drawing.

If the controller **6** receives an ON signal from this AND gate **5** next, the light source **8** and image sensor part **7** are driven and the fingerprint image is picked up. The image sensor part **7** is constituted from a high-speed image sensor, such as a CCD, and a lens system. The fingerprint image picked by the above operation is sent to another processing part from the interface **9** under control by the controller **6**.

By taking the AND of the ON signals generated by the pressure values in a plurality of places in this way, first of all, image pickup is nearly always possible in the same state within the range of the finger pressure by taking a technique for driving the image sensor part **7** and light source **8**. In addition, image pickup is not performed when there is partial bias in the finger pressure; hence, the distortion in the fingerprint image may be absorbed.

The pressure-sensitive part **4** will be explained next. The pressure-sensitive part **4** acts to generate an ON signal dependent on the finger pressure and send it to the AND gate **5**. However, two types of parts are considered for it. One generates an ON signal when the pressure is a certain value or more. The other one generates an ON signal only when the magnitude of the

pressure is within a certain fixed range.

The former part should only be turned ON and OFF by means of a contact simply using 1 sheet of mechanical contact or pressure conductive rubber; hence, there is a benefit because it may be implemented easily.

An example thereof is shown in Fig. 2. Figure 2(a) is an example of a mechanical contact and Fig. 2(b) is a contact using 1 sheet of pressure conductive rubber. **11A** and **11B** in Figure 2 are metal bodies; **12** is a protective sheet; **13A** and **13B** are electrodes; **14** is a pressure conductive rubber; **15** is a substrate.

In the case of the mechanical contact in Fig. 2(a), the metal bodies **11A** and **11B** parts come in contact due to contraction of the spring **3**, becoming a conductive state generating an ON signal.

In the case of the contact using 1 sheet of pressure conductive rubber **14** in Fig. 2(b), as understood from the explanatory diagram of the conductive state in Fig. 3 and the sensitivity characteristics in Fig. 4, pressure is applied by a press element **10'**; hence, electrodes **13A** and **13B** become a conductive state **14B** from an insulating state **14A**, generating an ON signal. The protective sheet **12** and substrate **15** in Fig. 2(b) have to do with the contact life and pressure regulation.

There are benefits in the examples of the two contacts shown in Figs. 2(a) and (b) because they may be implemented with ease. However, if the pressure in both examples exceeds the fixed

value, the effects are the same; hence, when the force applied to the pressure-sensitive parts **4** in 4 places in Fig. 1 is too strong, there is fear that the image will be picked up while it is distorted. Thus, in order to solve this problem, the latter type of contact is considered. Image pickup becomes possible by limiting the range of finger pressure due to the action of the aforementioned AND gate **5** if this pressure-sensitive part **4** is used. This is realizable, as stated below.

2 types of pressure conductive rubber **A** and **B** with different sensitivities are prepared as in Fig. 5. P_A and P_B are critical pressures at which the respective pressure conductive rubbers **A** and **B** become conductive states. The scale on the Y axis is an example. The pressure conductive rubbers **A** and **B** are made into commercial products. Specifically, there is a PCR **101** and PCR **105** (trade names) available from Nippon Gousei Goma K.K.

These 2 pressure conductive rubbers **A** and **B** are combined in 2 steps, as shown in Figure 6. **13C**, **13D** and **13E** in Fig. 6 are electrodes. If signals S_A and S_B turned ON when the respective pressure conductive rubbers **A** and **B** become conductive states, as shown in Fig. 7, only the ON signals within the certain pressure range between the P_A and P_B in Fig. 5 are sent to the controller **6**, as shown in the output diagram in Fig. 8.

Otherwise, a method in which the slide contact is used, as shown in Fig. 9, is considered for the method for limiting the output range of the pressure-sensitive part **4** in Fig. 1. **16A** and **16B** in Fig. 9 come in contact only in a certain fixed range

corresponding to contraction of the spring **3**, becoming a conductive state. The easiest method is one in which the output range of the pressure-sensitive part **4** is limited.

The explanation of the pressure-sensitive part **4** above is finished, but when the prism **2** moves because of the spring **3**, variation occurs in the obtained image every time it is picked up if the image sensor part **7** and light source **8** are fixed. Thus, the image sensor part **7** and light source **8** are integrated with the prism **2**. It is necessary that they be placed so that the relative positions are always constant.

As explained in detail above, data always may be obtained in the same state by performing pickup of the fingerprint image just when all the output values of the object in a plurality of places on the side being pressed are in the same range when the fingerprint image is obtained in this invention by pressing a finger onto a prism, etc. Accordingly, alleviation of preprocessing and improvement in the recognition rate are possible when fingerprint comparison is performed.

In addition, implementation of a small fingerprint image input device at a low price is possible in this invention; hence, there is a benefit because it may be easily built into household devices, etc.

It may be used in other applications so that the switching system of this invention is turned ON and OFF depending on the balance in the large amount of output.

In addition, there are numerous benefits including the fact that the input of information for other irregular surfaces, such as those of rubber stamps, also are possible.

4. Brief Description of the Figures

Figures 1(a) and (b) include a side view and a circuit block diagram as well as a top view and block circuit diagram of a practical example of this invention. Figure 2(a) is a drawing showing an example of the mechanical contact. Figure 2(b) is a drawing showing an example of a contact using 1 sheet of pressurize conductive rubber; Figure 3 is an explanatory drawing of the conductive state of the pressurize conductive rubber; Figure 4 is a drawing showing an example of the sensitivity characteristics of the pressurize conductive rubber; Figure 5 is a drawing showing the sensitivity characteristics of pressurize conductive rubber with different characteristics; Figure 6 is a drawing showing an example of the contact with 2 overlapping sheets of pressurize conductive rubber; Figure 7 is a logic circuit diagram until the signal from the contact in Figure 6 is sent to the AND gate; Figure 8 is an output diagram of the action of the contact in Figure 6; Figure 9 is a drawing showing an example of a slide contact.

In the drawing, 1: finger; 2: prism; 3: spring; 4: pressure-sensitive part; 5: AND gate; 6: controller; 7: image sensor part; 8: light source; 9: interface; 10: fitting; 11A, 11B: metal bodies; 12: protective sheet; 13A to 13E: electrodes; 14: pressurize conductive rubber; 15: substrate; 16A, 16B: metal

bodies; A and B: pressurize conductive rubber

[Figure 1]
(7) image sensor part;
(8) light source;
(6) controller;
(9) interface

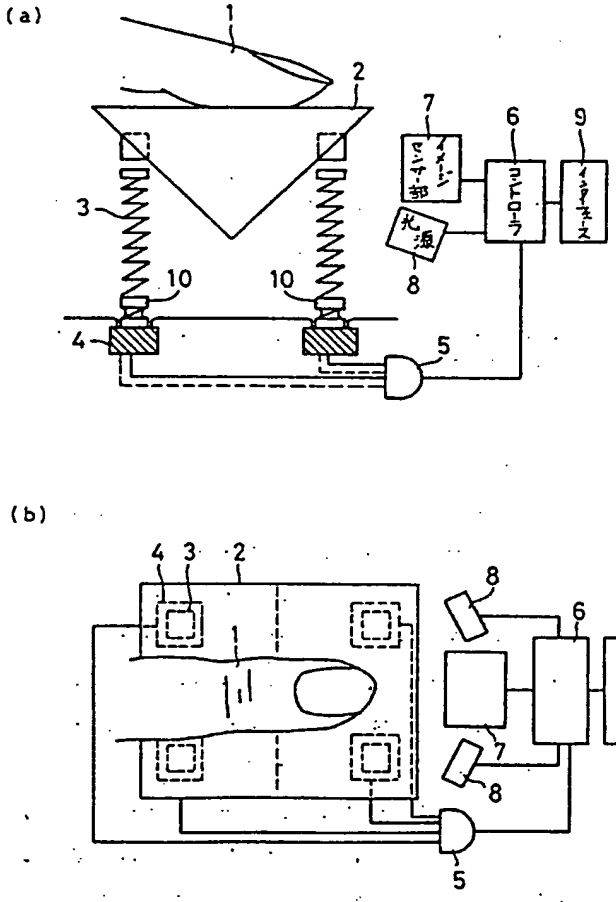
[Figure 3]
(14A) insulated state;
(14B) conductive state;
(14A) insulated state

[Figure 4]
Key: (a) high; (b) low; (c) resistance; (d) low; (e) pressure; (f) high

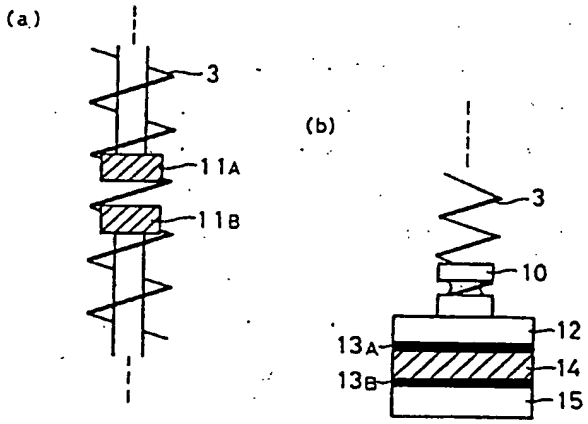
[Figure 5]
Key: (a) high; (b) low; (c) resistance; (d) low; (e) pressure; (f) high

[Figure 7]
Key: (a) to AND gate **5**

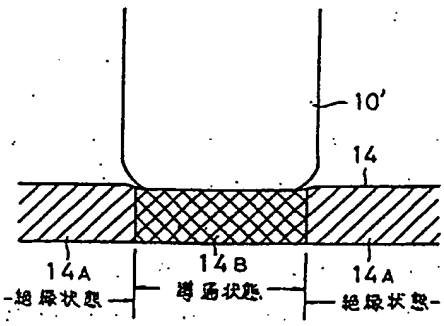
第 1 図 [Figure 1]



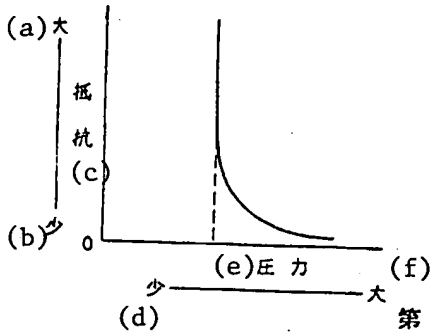
第 2 図 [Figure 2]



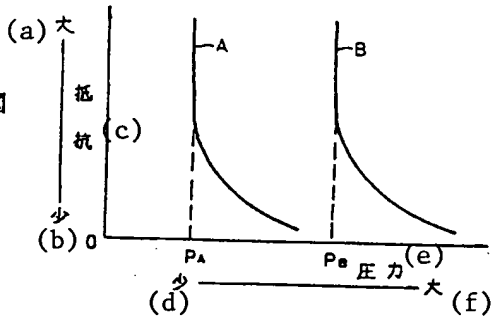
第 3 図 [Figure 3]



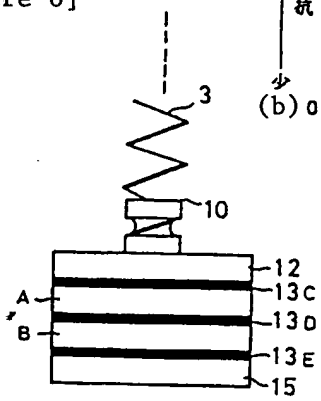
第 4 図 [Figure 4]



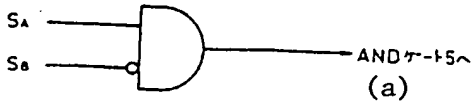
第 5 図 [Figure 5]



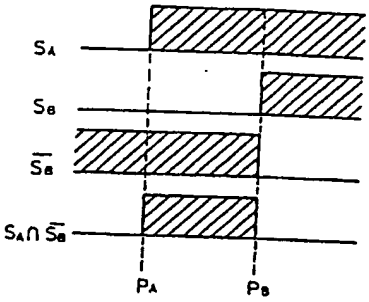
第 6 図 [Figure 6]



第 7 図 [Figure 7]



第 8 図 [Figure 8]



第 9 図 [Figure 9]